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Ēno interactive whiteboards as an innovative eco-technology solution in teaching Science and Technological subjects

Liliana Mata, Iuliana Lazar, Valentin Nedeff and Gabriel Lazar*

"Vasile Alecsandri" University of Bacau, Calea Marasesti 157, 600115, Bacau, Romania

Abstract

The aim of this study consists in exploring the benefits and facilities of ēno interactive whiteboards in teaching Science and Technology subjects. The impact of eco-technology upon education is highlighted in the first part of paper together with an eco-teaching impact measurement model, following the analysis of latest approaches focused on integration of innovative environmentally friendly materials and technological solutions in the educational context. The solution generated by exploiting the resources of eco-technology in education is represented by ēno interactive whiteboards. Their benefits are multiple: environmental, technological, pedagogical, psycho-social, and economic impacts. The use of new eco-technology solution is adequate in all disciplines, but in this study there are emphases their potential in teaching Science and Technological subjects.

Keywords: whiteboard; eco-technology; education; science;

1. Eco-technology solutions in education

There are implied two domains in an integrate vision that offers a new perspective upon the components of education sciences: technology and education. New developments are explored in order to highlight the environmental consequences. For example, the use of digital multimedia technologies has generated a new paradigm in our educational methodologies and strategies. It has given rise to new modes of learning and enabled new and innovative ways to deliver instructional materials to the learners [1]. There are identified

* Corresponding author. Tel.: +4-0234-542411; fax: +4-0234-545753.
E-mail address: glazar@ub.ro.

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some attempts to make connections and integration of environmental and technological solutions in the educational context: the political ecology of design and technology education [2]; a systematic instructional model for product eco-design education, including the review of related factors such as time schedule, capability of students, curriculum aims, teaching materials, and grading of assignments [3]; Advanced Systematic Inventive Thinking (ASIT), as a problem solving strategy for education and eco-friendly sustainable design [4]; eco-innovation as an opportunity for closer collaboration between universities and companies through technology centers [5].

In a scientific level, there are few studies and approaches from perspective of the integration of eco-technology in education, in practice there are already identified different solutions for educational institutions, to promote eco-friendly, green technologies [6].

In the new context, it results a triad in which there are integrated the three components (Figure 1). Following the interaction relation between the specific tools and solutions of each part, it will result the new concepts and approaches.

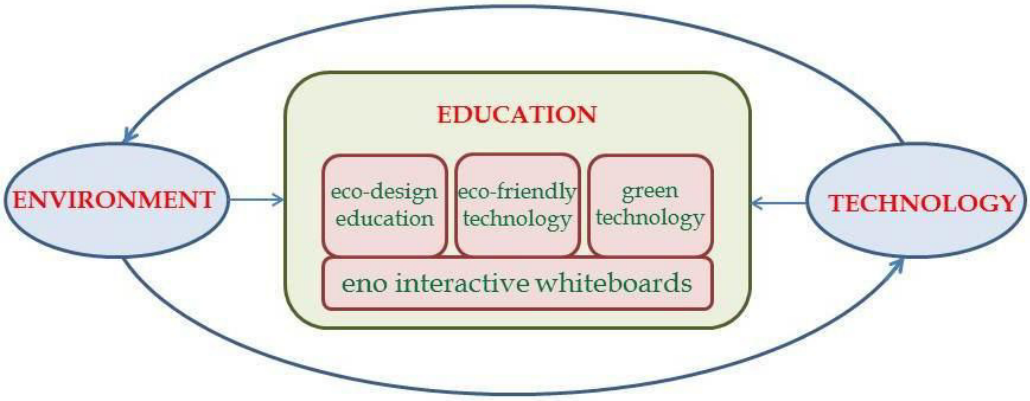

Fig. 1. The relation between eco-technology and environment

The connection between eco-technology and education represent a response to the new demands of society based knowledge. The educational actors cannot remain indifferent to the new challenges of ecology and technology. The eco-technological solutions will constitute for education a necessary support to design attractive lesson adapted to the students' needs. When eco-technologies are thoughtfully integrated with a sound pedagogical vision, students' views of teaching and approaches to learning can be positively affected [7]. In order to estimate the eco teaching impact on student's learning following experiment was performed.

2. Eco teaching impact measurement model

This research concerns the effect of teaching method using eco technologies over understanding the same scientific content, taught at the same time, from one lesson in Science and Environmental Engineering field. The fundamental topics are specific to Meteorology and Climatology and Environmental Physics domains. Statistical analysis of 38 reports was performed with SPSS, version 20.0 (the first group containing 23 students and the second containing 15). In the model it was used the following independent variable: Romanian baccalaureate admission average (Ba) for each student grouped into four categories (Ba between 6 and 7, Ba between 7 and 8, Ba between 8 and 9, and Ba between 9 and 10, where 6,7,8,9, and 10 represent the admission average). The dependent investigated variables are: student's assessment to understanding level of

the lessons taught by the classical method (Lc), student's assessment to understanding level of the lessons taught with eco method (Le), note for formative evaluation from Lc, note for formative evaluation from Le, degree of participation to Lc estimated by teacher, and degree of participation to Le estimated by teacher, too. To determine any within-group changes in the dependent variables from Lc to Le, it was carried out paired sample t-tests, i.e., pre/post for Lc and for Le. Results of Paired-sample t-tests revealed that was significant differences between students assessment to understanding level of the Lc and students assessment to understanding level of the Le (t =–4.588, df=37, p = 0.000), and between the degree of participation to Lc and the degree of participation to Le (t = –8.315, df=37, p=0.000). However, paired sample t test revealed no significant differences between note for formative evaluation from Lc and note for formative evaluation from Le (t =–1.745, df= 37, p=0.089). It also performed analysis of variance ANOVA [8], to examine mean differences in the dependent variables among Ba category. ANOVA results showed significant dependence of note for formative evaluation from Lc (F=3.306, df=3, p=0.032) and of student's assessment to understanding level of Le (F=3.780, df=3, p=0.019) on student knowledge reflected by Ba level. As a preliminary conclusion it may be assume that modern teaching technologies can be used also to those students with less knowledge. This justified more detailed analysis of innovative eco-technology solutions.

3. Ēno Interactive Whiteboards: an innovative eco-technology solution

3.1. Characteristics of ēno interactive whiteboards

Interactive whiteboards (IWBs), also known by various brand names such as *SmartBoards* and *Webster Boards*, and as electronic whiteboards, are currently being used in varied educational settings. Interactive whiteboards IWBs are large, touch-sensitive boards, which control a computer connected to a digital projector [9]. "*Ēno redefines the instructional leading edge with a 3-in-1 combination dry erase, magnetic, and interactive whiteboard that delivers lowest ownership cost, simple usability, and superior environmental sustainability*" [9,10].

3.2. Benefits of ēno interactive whiteboards

There are various benefits of ēno interactive whiteboards, as it can be observed from the Table 1: pedagogical, ecological, technological, psycho-social, aesthetical and economic.

4. Modalities of ēno interactive whiteboards integration in teaching Science and Technology

Information and Communication Technologies (ICT) can have a positive impact on sciences and technologies teaching and students' learning outcomes [11, 12].

Regarding the integration of ēno interactive whiteboards in education, there are not contributions in terms of concrete projects and products, but no research. The analysis of reference literature indicates that there is consistent research in the domain of using interactive whiteboard in teaching sciences and technology subjects.

The ēno interactive whiteboards may be integrated in sciences and technological subjects in different modalities:

- designing the educational software to teach the lessons from these subjects;
- elaborating the exercises for students to apply and represent better the abstract notions of sciences and technological subjects;

Table 1. The benefits of ēno interactive whiteboards

Categories of benefits	Examples
Pedagogical	- *Interactive teaching and learning:* ēno gives teachers the power to optimize lessons, engage students and capture attention. With multi-user interactivity, ēno makes collaborative learning a reality. - *Flexibility*. Save valuable lesson time by controlling and interacting with ēno board. - *Personalized learning on their level.* Students and teachers of any height comfortably interact with lesson content with a simple lift or push of the handle. - *Improving results in the classroom*. Ēno encourage collaboration and discussion, and help create classrooms that improve instruction and learning outcomes.
Environmental	- *Cleaner and greener classrooms*. The ēno board is environmentally certified and recyclable. The ēno solution helps conserve natural resources and ensures clean air in the classroom-protecting our earth and children for generations.
Technological	- *Simplest installation:* ēno installs simply and quickly. No complex wiring or cabling, no power and data outlets to add. - *Replace instead of repair*. With all technical components consolidated into a Bluetooth-enabled stylus, worries about multiple points of failure are a thing of the past. - *Keep the conversation going*. Save and distribute the entire interactive session, with one easy click.
Psycho-social	- *Social integration and adaptation*. The use of ēno develops the social abilities and integration capacity of students, following the implication in interactive activities. - *Personality and psychological development*. There are evident the impact of ēno upon the forming the features of students personality, in terms of self-esteem, self-efficacy and psychological development.
Economic	With ēno's lifetime warranty, no power requirements or expensive replacements.

- involving students in teaching sciences and technological subjects grated interactivity values of eco-technology solution;
- forming the ecological attitudes upon the educational and social environment, a new category of attitude implied in science and technological lesson;
- Developing the psycho-social abilities and skills of students, aspects that in the traditional teaching of sciences and technological subjects are difficult to stimulate in the teaching process.

It results a new educational paradigm that involved the specific elements of eco-technology domain in teaching sciences and technological disciplines (Figure 2).

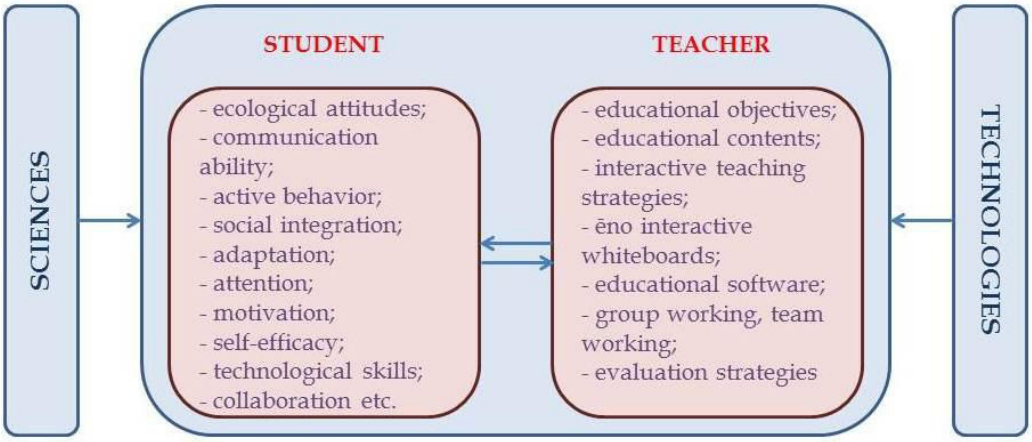

Fig. 2. The representation of educational context in sciences and technological subjects teaching

National Science Teachers Association [13] noted that general teaching skills should include the successful use of technological tools.

5. Conclusions

The results suggest that specific elements of eco-technology domain in teaching sciences and technological disciplines may create a new educational paradigm. It were identified various benefits of ēno interactive whiteboards especially from environment and education impact. Learning to teach Sciences and Technologies with ēno is an important concern, and should be integrated into the teacher education curriculum.

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